

# Channel Islands Monitoring Workshop

## Participant Worksheet Results

On March 14, 15 and 16, 2003 the California Department of Fish & Game and Channel Islands National Marine Sanctuary hosted a Workshop to discuss monitoring plans for the newly established Channel Islands Marine Protected Areas. The Workshop was held at the University of California, Santa Barbara's Bren School of Environmental Science and Management. Participants met in small groups to discuss which questions needed to be addressed, what existing and new programs could be used for monitoring, where and when monitoring should occur, and other details. The following worksheets were completed by the participants and have been reviewed to ensure all their ideas were included. The worksheets are being provided to Workshop participants and other interested parties in order to fill any gaps in the information and to help prioritize activities for a draft monitoring plan. The next steps will include developing a framework of monitoring programs to be conducted then a complete long-term monitoring plan.

### General Recommendations:

The following recommendations are summarized from the notes of all working groups and are provided as additional information to go along with the worksheets. **The statements are the views of the participants and do not necessarily reflect what will be incorporated into a final monitoring plan.** They are provided here to allow all participants and the public to see what types of ideas and concerns were raised. Many comments below came from both biological and social and economic groups.

- A single representative is needed to coordinate monitoring activities (or one for biological and one for social and economic). For socioeconomic monitoring this may need to be a neutral contract position.
- Need to include Fishermen's knowledge, expertise, and equipment in monitoring efforts
- Cooperative efforts and electronic logbooks were suggested by both social and economic and biological working groups
- Don't neglect methods such as plankton tows which can produce detailed information for stock assessment at lower costs than diving or ROV surveys.
- Database management and data collection/distribution were major areas of concern; how do you collect and distribute detailed data without revealing sensitive or private information?
  - A potential solution is to collect data on as fine a scale as possible, but only release it publicly in summary (e.g., if less than 3 boats fished in a location, do not represent it at all).
  - Another solution is to reference data based on distance from reserve, not its specific geo-reference.
- If the reserves were put up for nearshore rock and kelp areas, and nearshore fisheries- then focus the effort on studying the impact on what the reserves were put there for in the first place - also need study on larger scale to put into context
- Aside from the trophic interactions and habitat mapping groups, all of the biological monitoring programs have similar objectives;
  - a. Compare community composition/structure/diversity inside and outside reserves;

- b. Compare abundances of key species inside and outside reserves;
- c. Compare demography of selected species inside and outside reserves;
- d. Estimate spillover of key species.
- Good to develop a program that we can apply up and down the coast at other areas
- Marine Mammal/Fisheries interactions - do not ignore the impacts/effects from and to top level predators like sea lions. Study foraging, diet, and migrations to determine impacts inside and outside MPAs.
- The pressure will be to do as much baseline monitoring as possible with minimum funding.
- A major data gap exists for recreational private boaters; this could be coordinated with volunteer and electronic logbook efforts.
- The monitoring will be for naught if we are unable to enforce boundaries.
- Long-term monitoring is an absolute necessity. We don't know the time course of direct effects of MPA – but given the inherent year-to-year variability in most species populations, it is likely that even relatively large MPA effects on those species that are directly affected (e.g. 50% increases in average population size) will take on the order of a decade to detect. Most of the species potentially affected by MPA will be *indirectly* affected and so are likely to require much longer monitoring in order to detect effects. An added complication is that the direction of these effects may be hard to predict. Given these facts, long-term monitoring is essential for us to understand potential MPA effects. Don't ignore the potential for long-term studies in an effort to tease out short-term results.
- Many groups recommended oversight/data review/peer review committees.
- Do not ignore the inherent disjunction in the variability of species found at the different reserves. While a certain fish maybe present in one area it naturally may not be found at a different reserve.
- A potential data collection and distribution site is at the license sales areas, ask questions when people purchase fishing licenses, possibly require this?
- The results need to be able to satisfy the public, govt., fishing and recreational interests. Sampling only four times of the year may satisfy the scientific community but this may not satisfy the rest of the stakeholders. People want to make sure the sampling is done right.
  - It was suggested that other groups (such as REEF, volunteers, etc...) could be used to increase the frequency of sampling, and they should coordinate their activities with the scientific surveys.
- There is a major responsibility on the part of the scientists to be able to explain statistical analysis and project design to the non-scientific community.
  - In the Florida Keys there was success with involving the scientific, recreational and commercial community. It makes a big difference to get people “into the water” and let them see for themselves.
- There is a concern that the current data that are available are not an accurate depiction of what is actually out there.
- Need to do trapping and hook and line at the same time as diver surveys are done; Fisherman should be utilized to tag fish
- Use low cost alternative programs for intensive monitoring.
- Divers surveys may be best for rocky reef monitoring, but these should be supplemented with trap and hook and line (stick gear not rod and reel) surveys. Some

debate about what gear (trap vs. hook and line) was better for sampling nearshore rockfish community.

- There may be a bias on focusing on benefits of edge effect. Need to also find out about displacement. Need to keep other effects in mind. Can MPAs have localized depletion at the edge?
- Need better seafloor habitat characterization maps at appropriate scales (1 meter) bathymetry and backscatter. This will provide a roadmap for monitoring sites in similar habitats, better to have first in and out of reserves
- One group noted that Non-lethal take should be the only type allowed for research in MPAs.

#### **Site Selection Comments:**

- Need to consider the relative location of reserves based on current patterns. Up current sites should be different than down current.
- Need to match intertidal, subtidal, and deep sites to gather information on indirect effects.
- Sites must be located in similar conditions and habitats for appropriate comparison.
- Some reserves could be eliminated from monitoring (or at least frequent monitoring) due to weather/conditions (e.g. Miguel) - however - Need sampling at all islands and reserves to include biogeographic differences (for at least first year). Fishermen want all islands/reserves covered as well.
- User groups have specific habitat knowledge that can be used to determine study sites. They can help provide information on where equivalent habitats are inside, near, and far from MPAs.

## Biological Monitoring

<b>Group: Intertidal monitoring</b>
<p>Question/Topic/Goal: <b>Community Monitoring</b></p> <p>1a. Do species inside MPAs change in abundance (densities and cover) relative to areas adjacent and distant from MPAs?</p> <p>1b. Does community structure, species richness/diversity, resilience and distribution change within, adjacent to and distant from MPAs.</p> <p>2. How do changes in populations and communities differ among MPAs in the three biogeographic regions at the Channel Islands?</p>
<p>Monitoring Activity:</p> <p>MMS/PISCO comprehensive surveys.</p>
<p>Data Collected:</p> <p>Refer to MMS/PISCO protocols. Cover and density data on species and vertical profiling and mapping of shoreline.</p>
<p>Species/Habitat Monitored:</p> <p>Refer to MMS/PISCO protocols. All encountered species.</p>
<p>Methods:</p> <p>Refer to MMS/PISCO protocols. Point contact and plot samples.</p> <p>Voucher specimen collection and curation.</p>
<p>Sites (include name if existing / location / MPA name):</p> <p>Same set of sites as NPS/MARINE population monitoring. N = 27</p>
<p>Frequency of Monitoring:</p> <p>Once per year.</p>
<p>Program used (if existing, describe if not):</p> <p>MMS/PISCO.</p>
<p>Power to detect change:</p> <p>To be determined.</p>
<p>Estimated Staff / Funding Required (especially if additional):</p> <p>See Pete Raimondi at UC Santa Cruz (831-459-5674)</p>

<b>Group: Intertidal monitoring</b>
<p>Question/Topic/Goal: <b>landscape</b></p> <p>1.b. Does community structure, resilience and distribution (landscape level shoreline community coverage) change within, adjacent to, and distant from MPAs.</p> <p>2. How do changes in populations and communities differ among MPAs in the three biogeographic regions at the Channel Islands?</p> <p>4. Are the monitored populations and communities providing data representative of the region?</p>
<p>Monitoring Activity: Shoreline survey.</p>
<p>Data Collected: Digital images of the shoreline and maps of community structure.</p>
<p>Species/Habitat Monitored: Key population or habitat-structuring populations and community types.</p>
<p>Methods: Landscape-level imaging, from helicopter or equivalent during periods of low tide. Mapping of community types for analysis of distribution and abundance.</p>
<p>Sites (include name if existing / location / MPA name): Shorelines of the entire CINMS.</p>
<p>Frequency of Monitoring: Annual. On annual basis initially, then determine frequency based the amount of change detectible per year over the first several years. More frequent monitoring could be a waste of resources.</p>
<p>Program used (if existing, describe if not): Repeat of Mineral Management service shoreline survey (mid-1970s). Not an existing program.</p>
<p>Power to detect change: Unknown. To be determined.</p>
<p>Estimated Staff / Funding Required (especially if additional): five half-days of helicopter time (\$700 or \$800 per hour) = \$14000 - \$16000 processing time (need professional for ground-truthing and GIS expertise) Estimate: \$60000 for processing. 14 person-days for the professional and the remainder would be for GIS loading and processing.</p>

<b>Group: Intertidal monitoring</b>
<b>Question/Topic/Goal: Population</b> 1.a. Do species inside MPAs change in size/age structure (YOY recruitment & older), numbers (densities/abundance) and biomass relative to areas adjacent and distant from MPAs? 1.b. Does community structure, species richness/diversity, resilience and distribution (landscape level shoreline community coverage) change within, adjacent to, and distant from MPAs. 2. How do changes in populations and communities differ among MPAs in the three biogeographic regions at the Channel Islands?
<b>Monitoring Activity:</b> National Park Service/MARINE - Shoreline monitoring
<b>Data Collected:</b> Refer to NPS/MARINE monitoring protocols
<b>Species/Habitat Monitored:</b> Refer to NPS/MARINE monitoring protocols - Table 3b in MARINE handout.
<b>Methods:</b> Refer to NPS/MARINE monitoring protocols -Table 4 in the MARINE handout
<b>Sites (include name if existing / location / MPA name):</b> Refer to NPS/MARINE monitoring protocols. There are geographic gaps that would require substantial changes in current programs to address MPA questions. Four additional sites would need to be added (Gull Island, Carrington Point, South Point, and Judith Rock). Two additional sites in reserves (Gull Island and North Anacapa) would be needed to measure within site variation and provide measures of certainty. An additional site (Valley Anchorage, Santa Cruz Island), not in an MPA would be needed to assess distant effects in the Californian province.
<b>Frequency of Monitoring:</b> Twice per year (spring and fall).
<b>Program used (if existing, describe if not):</b> NPS/MARINE with additional sites noted above.
<b>Power to detect change:</b> Refer to Lafferty <i>et al</i> , 2001 ( <a href="http://www.nps.gov/chis">http://www.nps.gov/chis</a> )
<b>Estimated Staff / Funding Required (especially if additional):</b> Approximately \$60,000 for existing monitoring by NPS. With 6 or 7 additional sites, rough approximation would be an additional \$30,000 per year due to scaling. Information management, \$20,000, to make information available for regional analysis through MARINE.

<b>Group: Intertidal monitoring</b>
Question/Topic/Goal: <b>Productivity</b> 3. Does recruitment of selected taxa vary in and adjacent to MPAs?
Monitoring Activity: Measuring larval recruitment.
Data Collected: Counts of larval types.
Species/Habitat Monitored: Mussels, barnacles, abalone, and owl limpets.
Methods: PISCO larval settlement collecting modules. Automated PISCO identification methods.
Sites (include name if existing / location / MPA name): 50% of the NPS/MARINE sites stratified across the three biogeographic regions.
Frequency of Monitoring: Spring, summer and fall.
Program used (if existing, describe if not): PISCO field and lab protocol with additional sites and samples.
Power to detect change: To be determined.
Estimated Staff / Funding Required (especially if additional): \$100,000 per year for operations and a one-time cost of \$100,000 to develop specific automated identification process.

<b>Group: Intertidal monitoring</b>
Question/Topic/Goal: <b>Sandy beach monitoring</b> 1.a. Do species inside MPAs change in size/age structure (YOY recruitment & older), numbers (densities/abundance) and biomass relative to areas adjacent and distant from MPAs? 2. How do changes in populations and communities differ among MPAs in the three biogeographic regions at the Channel Islands?
Monitoring Activity: Distribution and abundance of sandy beach macrofauna.
Data Collected: Density of populations.
Species/Habitat Monitored: Refer to NPS sand beach monitoring protocol (8 species).
Methods: Refer to NPS sand beach monitoring protocol (8 species).
Sites (include name if existing / location / MPA name): Refer to NPS sand beach monitoring protocol (8 species). Need to add 4 sites each for San Miguel and Santa Cruz islands (8 additional sites).
Frequency of Monitoring: Annually.
Program used (if existing, describe if not): NPS sand beach monitoring protocol with additional sites.
Power to detect change: To be determined.
Estimated Staff / Funding Required (especially if additional): \$85,000



<b>Group: Shallow Subtidal Non-Fish Monitoring</b>
<p>Question/Topic/Objective: <b>Community Monitoring</b></p> <p>Do benthic communities change in response to MPAs (inside vs. outside), and if so, how (magnitude and rate)?</p> <p>Rationale: The group felt that few species (those harvested commercially or for sport) will be directly affected by the MPAs. As a result the expected effects of the MPAs will be the result of indirect effects resulting from species interactions. Because of this, many of the potential species-level effects will be extremely difficult to predict, likely exhibiting large temporal and spatial variability. Since for all but a few species we have no good way of predicting which species populations will show the effects of MPAs, we must design monitoring protocols that will allow us to track changes in as many species as practicable, i.e., a protocol that monitors at the community level. This focus challenges us to find cost-effective methods for monitoring many species in many places inside and outside of the marine protected areas.</p>
Monitoring Activity: benthic surveys (see Methods below)
Data Collected: taxonomic presence/absence, frequencies, densities, size structure (depending on species)
<p>Species/Habitat Monitored: Taxa &amp; habitats being monitored in NPS/KFM and PISCO protocols; in addition, invasive species and sea otters should be recorded. Invasive species will be recorded in the course of the core protocol, and perhaps could be called out for those collecting data via electronic logbooks. Sea otters and probably pinnipeds should be monitored in some fashion, since these predators will be confounding variable that could lead to a spurious strengthening or weakening of the MPA signal.</p>
Methods: diver quadrat/transect techniques; electronic logbooks; boat surveys (otters and pinnipeds)
<p>Sites (include name if existing / location / MPA name)</p> <p>Minimum: 1 site within and 2 sites outside of each MPA</p> <p>For selected MPAs: 3 sites within and 9 sites outside the MPA, with outside sites arranged in groups of 3 across 3 distance zones.</p> <p>The group didn't feel that it could adequately review in the available Workshop time which MPAs should be selected as focal sites for more intensive study, but three focal MPAs may be adequate for comparing the responses of MPAs in more detail. The specific focal MPAs and the study sites within and outside could be efficiently chosen after;</p> <ol style="list-style-type: none"> <li>(1) further review of existing and planned NPS/KFM and PISCO sites,</li> <li>(2) More consideration of the various biogeographic and oceanographic attributes of the MPAs (in order to have focal MPAs in a range of settings), and</li> <li>(3) Further input from scientists and fishermen (via smaller focus groups?) about the distribution of comparable habitats within and outside of potential focal MPAs. This review should then be able to indicate the minimum number of new and relocated sites that will be necessary for the focal MPA studies.</li> </ol>
<p>Frequency of Monitoring: yearly. One rationale for yearly (as opposed to more frequent) sampling is that even yearly samples display non-independence and therefore increasing sampling frequency would have the effect of repeatedly sampling the same point in time. This is because population changes for many of the species take place at a rate that is lower than an annual one. Such over-sampling would end up being statistically discounted and would represent an inefficient use of resources.</p>
Program used (if existing, describe if not): NPS/KFM and PISCO, and extensions across new sampling sites
<p>Power to detect change: Data from existing MPAs should be analyzed for estimation both of effect sizes and time horizons for expected effects. We expect that the power to detect significant changes will be low given realistic sampling effort, effect sizes, rates of change, and yearly variation.</p>
<p>Estimated Staff / Funding Required (especially if additional): Depends on how many additional sites are needed after reallocation of existing effort. ~Cost/site is estimated to be ~\$10-20K/year (higher initially, then cheaper).</p>

<b>Group: Shallow Subtidal Non-Fish Monitoring</b>
<p>Question/Topic/Objective: <b>Species Monitoring</b></p> <p>Do populations of selected species of interest change in response to MPAs (inside vs. outside), and if so, how (magnitude and rate)?</p>
<p>Monitoring Activity: Additional monitoring</p> <p>Since this worksheet, for the sake of time, summarized multiple monitoring targets and techniques, it was difficult to concisely describe it as a single “activity.”</p> <p>The basic rationale was the broadening of the previous monitoring program (focused on benthic assemblages via transects &amp; quadrats) to additional species, life stages, and habitats of interest. The species of interest could be characterized as those with ecological and existing or potential commercial interest. Larval traps, coupled with other oceanographic and benthic data, will provide important “process” information about particular species or life-history responses to MPAs (especially if species with a range of disposability can be effectively trapped), as well as the general behavior of the ecosystem. Additional habitats (and infaunal species therein, such as worms, clams, crustaceans, etc.) include sand/mud flats not represented in the previous kelp forest/rocky monitoring, as well as a turf algal microhabitat for small amphipods and other crustaceans that are known to be an important food source for small fishes (and therefore a consistent indicator of ecosystem condition). Note that we discussed other habitat types, especially seagrasses, but didn't really get to the sampling issues associated with them.</p>
<p>Data Collected:</p> <p><b>Traps:</b> relative abundance, size structure, CPUE, sex ratio, reproductive state, health</p> <p><b>Electronic log books:</b> size structure, CPUE, sex ratio, gonad indices (depends on species)</p> <p><b>Algal turf destructive sampling:</b> abundance, biomass, size structure, species composition, digital photos</p> <p><b>Sediment core destructive sampling:</b> species comp., density, biomass, size structure; sediment grain size</p> <p><b>Larval collectors:</b> relative abundance of recruits of selected spp.</p>
<p>Species/Habitat Monitored:</p> <p><b>Traps:</b> Crabs (<i>Cancer spp.</i>, <i>Loxorhynchus grandis</i>), spiny lobster, octopus, <i>Kelletia kelletii</i></p> <p><b>Electronic log books:</b> red &amp; purple urchins, lobsters, crabs, sea cucumbers, abalones</p> <p><b>Algal turf destructive sampling:</b> algal turf &amp; epifauna</p> <p><b>Sediment core destructive sampling:</b> infauna in mud and sand</p> <p><b>Larval collectors:</b> urchins, lobsters, crabs, small crustaceans, scallops &amp; other bivalves</p> <p>Note that there was substantial discussion about the strengths and weaknesses of various species for MPA monitoring (though limited decisions given the information and time on hand). For example, although lobsters are of considerable commercial interest, they are at the edge of their natural distribution in the Channel Islands and their recruitment appears to be driven by El Niño events (e.g., warmer water from the south), making them a poor choice for focused larval sampling. Nevertheless, lobsters could be sampled while trapping for other species.</p>
<p>Methods:</p> <p>traps, electronic log books, digital photos, algal turf destructive sampling, sediment core destructive sampling, larval traps</p> <p>The method of algal turf sampling that was discussed followed the protocols described in Schmitt &amp; Holbrook 199?. It consists of simply grabbing and bagging by hand some amount of algae and associated and epifauna; probably while diving and sampling benthic quadrats. In the lab, epifauna would be separated from the algae, identified to some taxonomic or functional level, and counted. Algal volumes or biomass (and perhaps taxa) could also be recorded for generating infaunal densities.</p>
<p>Sites (include name if existing / location / MPA name)</p> <p>Employ stratified random sampling whenever possible at multiple sites inside, near edges of MPAs, and outside between MPAs (“controls”).</p> <p>The “stratified random sampling” was referring to the more intensive, distance (or gradient) sampling that could detect edge or other spillover effects from MPAs. This type of sampling (via traps, cores, photos etc.) probably only needs to be done at selected focal sites, as discussed on the previous worksheet.</p>

<b>Group: Shallow Subtidal Non-Fish Monitoring</b>
Question/Topic/Objective: <b>Species Monitoring (Cont.)</b>
<p>Frequency of Monitoring:</p> <p><b>Traps &amp; electronic log books:</b> continual - Sampling frequency would be largely based around normal fishing efforts (except in the case of current, non-commercial species, such as abalone). Since commercial fishermen target areas that are likely to have higher abundances of target species, , the spatial distribution of effort will likely need to be “evened out” with a somewhat more systematic sampling design for better coverage and clearer statistical inferences. Such sampling could be designed and contracted out (cooperatively to fishermen or to traditional researchers) as a pure research effort. Sampling for abalone <i>Haliotis</i> spp., which are currently under a harvesting moratorium, would be another example where cooperative monitoring by fishermen would be extremely useful.</p> <p><b>Algal turf destructive sampling:</b> yearly</p> <p><b>Sediment core destructive sampling:</b> yearly</p> <p><b>Larval traps:</b> variable - Larval trapping frequency should depend on the species of interest. Some species (e.g., urchins?) settle relatively non-seasonally and sporadically, while other taxa have more predictable and narrow windows of settlement. Since probably <i>most</i> of the species of potential interest – even those with fairly predictable seasonal settlement – have enough temporal variability within their recruitment seasons to make it impossible to design an effective pulsed sampling regime. This problem is compounded by the fact that there is asynchrony among sites. A better approach to larval monitoring would be to establish a few sites representing major ecological regions (e.g. north, south, east &amp; west sides of the northern channel islands and a site at Santa Barbara island) monitor these on a biweekly basis. If more spatial representation is desired (e.g. inside and outside of MPAs), one could then do pulsed monitoring at the additional sites following a settlement signal at the 4 or 5 stations at which bi-weekly monitoring was conducted.</p>
<p>Program used (if existing, describe if not):</p> <p><b>New cooperative trapping and electronic log book programs:</b> Commercial Fishermen</p> <p><b>Algal turf destructive sampling:</b> Lenihan lab</p> <p><b>Sediment core destructive sampling:</b> Lenihan lab</p> <p><b>Larval traps:</b> PISCO, Sea Urchin Fishing Advisory Comm., and extensions</p>
Power to detect change: see comments on previous page
<p>Estimated Staff / Funding Required (especially if additional):</p> <p>Depends on how many additional sites are needed after reallocation of existing effort.</p> <p>Trapping: Trapping or harvesting within MPAs would need contractual arrangements with commercial fishermen to allow such harvesting and to compensate them for services rendered.</p>

<b>Group: Shallow Subtidal Fishes</b>
<b>Question/Topic/Goal: Spillover</b> What are the patterns and rates of movement of adults and juveniles: Into and out of reserve; as a function of density; as a function of habitat, size, area, shape; how does this change over time?
<b>Monitoring Activity:</b> Combination of diver surveys, traps, hook and line and other specialized techniques: Extensive diver surveys, traps, hook and line monitoring throughout all reserves (inside and out and on edge) (annual). Intensive (more frequent) monitoring among selected sites-design depends on specific question. Use alternative programs (collaborative and volunteer) for intensive monitoring.
<b>Data Collected:</b> Abundance, density, size for focal species (and other species of interest)
<b>Species/Habitat Monitored:</b> Habitat: rock reefs Focal species (with additional information gained on other associated species): Kelp rock fish, Sheephead, Kelp and sand bass, Cabezon, Garibaldi, Black surf perch Note: The group discussed the potential for monitoring of mobile fish species (e.g., yellowtail, white seabass, billfish, and tunas) and decided that since changes in population structure for these species would be difficult to determine they should not be the primary focus of MPA monitoring.
<b>Methods:</b> Annual density surveys coupled with short-term methods including: Tag and recapture, Acoustic tagging
<b>Sites (include name if existing / location / MPA name):</b> Conducted at the intensive monitoring sites, selected for - Accessibility, Collaborative efforts with fishermen, Geographic representation, Suitable habitat for comparison, Previous data from existing programs 6 sites would be chosen per sampled reserve; 3 inside (center and edges), 3 outside spaced equally between sites.
<b>Frequency of Monitoring:</b> Core annual monitoring and supplemental funding for targeted studies. Some insight gained in annual monitoring efforts. More focused studies on shorter time scales.
<b>Program used (if existing, describe if not):</b> Same as W/in reserves
<b>Power to detect change:</b> Detection affected by: Inherent variability, Initial conditions, Life history attributes ex. Growth rates, recruitment rates, fecundity, Sample size and frequency
<b>Estimated Staff / Funding Required (especially if additional):</b> Not possible to determine w/out additional effort on specific plans.

<b>Group: Shallow Subtidal Fishes</b>
<p>Question/Topic/Goal: <b>Changes within Reserves compared to adjacent and distant areas</b></p> <p>Do focal species inside MPAs change in size, numbers, and biomass relative to areas adjacent and distant from reserves?</p> <p>How do changes in size, numbers, biomass and diversity of animals and plants differ among reserves?</p> <p>Does estimated larval production of focal species increase (change) after protection?</p> <p>Is larval production correlated to MPA size/location/habitat?</p>
<p>Monitoring Activity:</p> <p>Combination of diver surveys, traps, hook and line and other specialized techniques:</p> <p>Extensive diver surveys, traps, hook and line monitoring throughout all reserves (inside and out and on edge) (annual).</p> <p>Intensive (more frequent) monitoring among selected sites-design depends on specific question. Use alternative programs (collaborative and volunteer) for intensive monitoring.</p>
<p>Data Collected:</p> <p>Abundance, density, size for focal species (and other species of interest)</p>
<p>Species/Habitat Monitored:</p> <p>Focal species (with additional information gained on other associated species):</p> <p>Kelp rock fish, Sheephead, Kelp and sand bass, Cabezon, Garibaldi, Black surf perch</p> <p>Note: The group discussed the potential for monitoring of mobile fish species (e.g., yellowtail, white seabass, billfish, and tunas) and decided that since changes in population structure for these species would be difficult to determine they should not be the primary focus of MPA monitoring.</p>
<p>Methods:</p> <p>Visual diver surveys (of focal species, except Cabezon, grass rockfish, Monkeyface Eel)</p> <p>For Cabezon and others use trap and hook and line.</p>
<p>Sites (include name if existing / location / MPA name): Two scales: <b>throughout all reserves</b>, and <b>more localized</b>, intensive monitoring for spillover and other questions.</p> <p>(Site selection depends on specific question and criteria, group suggested a small subgroup could provide specific input in a short timeframe.)</p>
<p>Frequency of Monitoring: Core annual monitoring and supplemental funding for targeted studies.</p>
<p>Program used (if existing, describe if not): REEF, Kelp Forest (needs to be expanded), Pondella Nearshore Fishes, PISCO (expand to other sites \$?), SCUBA Love Lab, CRANE</p>
<p>Power to detect change:</p> <p>Detection affected by: Inherent variability , Initial conditions, Life history attributes ex. Growth rates, recruitment rates, fecundity, Sample size and frequency</p>
<p>Estimated Staff / Funding Required (especially if additional):</p> <p>Not possible to determine w/out additional effort on specific plans.</p>

<b>Group: Deep Subtidal</b>																					
Question/Topic/Goal: <b>Density Monitoring</b> <b>H0</b> - There is no difference in population density of species inside the MPA, relative to areas adjacent to and distant from the MPA.																					
Monitoring Activity: Visual and Acoustic Surveys																					
Data Collected: Density estimation – counts of organism per unit area																					
Species/Habitat Monitored: Combination of random sampling and index areas, both stratified by habitat (see program box below). Similar habitats - control for biophysical factors Focus on harvested species and different trophic levels, predator/prey/competitor <table border="0"> <tr> <td>Abalone</td> <td>Cowcod</td> <td>Squarespot rockfish</td> </tr> <tr> <td>Angel sharks</td> <td>Lingcod</td> <td>Squid</td> </tr> <tr> <td>Blue Rockfish*</td> <td>Lobster</td> <td>Swordspine rockfish</td> </tr> <tr> <td>Bocaccio</td> <td>Olive rockfish</td> <td>Urchin (purple and red)</td> </tr> <tr> <td>CA Halibut**</td> <td>Pygmy rockfish</td> <td>Vermillion</td> </tr> <tr> <td>Cabazon**</td> <td>Rock crab</td> <td>White Abalone</td> </tr> <tr> <td>Copper</td> <td>Sheephead**</td> <td></td> </tr> </table> *historically done very well **can tell larvae apart – does not require DNA analysis to identify	Abalone	Cowcod	Squarespot rockfish	Angel sharks	Lingcod	Squid	Blue Rockfish*	Lobster	Swordspine rockfish	Bocaccio	Olive rockfish	Urchin (purple and red)	CA Halibut**	Pygmy rockfish	Vermillion	Cabazon**	Rock crab	White Abalone	Copper	Sheephead**	
Abalone	Cowcod	Squarespot rockfish																			
Angel sharks	Lingcod	Squid																			
Blue Rockfish*	Lobster	Swordspine rockfish																			
Bocaccio	Olive rockfish	Urchin (purple and red)																			
CA Halibut**	Pygmy rockfish	Vermillion																			
Cabazon**	Rock crab	White Abalone																			
Copper	Sheephead**																				
Methods: Direct visual observations (archived) Acoustic surveys for pelagic and semi-pelagic species Species dependent timing Calibrate methods																					
Sites (include name if existing / location / MPA name): These can be used to select 'ideal' sites if all MPAs cannot be monitored. List need to be prioritized. Need a paired experimental design (like areas inside & outside MPA). Well enforced sites Historical and current fishing (inside and outside MPA) Representatives sites within each biogeographic zone Large vs. small reserves (where applicable) Current and past monitoring Exposure (leeward, windward) Habitat type (inside and outside MPA) – depth, substrate, biota																					
Frequency of Monitoring: Initial baseline for all species inside and out MPA <b>Annually</b> (or more frequently) for fast growing species and those that are recovering or harvested species, <b>Less frequently</b> for slow growing species																					
Program used (if existing, describe if not): Ideally have new program that factors in the control variables mentioned above in a paired design (See Table 1 in review of existing programs: Overlap between research programs and Workshop questions for information on existing programs).																					
Power to detect change: Utilize the results of existing paired pilot studies (e.g., Anacapa, Big Creek, Hopkins, Lobos, etc.) to estimate sample size requirements.																					
Estimated Staff / Funding Required (especially if additional): Difficult to apply funding to one particular question, a well designed program will address several questions. Based on Anacapa study (small area) \$50k and 3 people																					

<b>Group: Deep Subtidal</b>																					
Question/Topic/Goal: <b>Growth/Size Monitoring</b> <b>H0</b> - There is no difference in growth of species inside the MPA, relative to areas adjacent to and distant from the MPA.																					
Monitoring Activity: Catch, Measure, and tag studies																					
Data Collected: Size at age by appropriate hard part sample, Mark and recapture																					
Species/Habitat Monitored: Similar habitats - control for biophysical factors, Focus on harvested species: <table border="0"> <tr> <td>Abalone</td> <td>Cowcod</td> <td>Squarespot rockfish</td> </tr> <tr> <td>Angel sharks</td> <td>Lingcod</td> <td>Squid</td> </tr> <tr> <td>Blue Rockfish*</td> <td>Lobster</td> <td>Swordspine rockfish</td> </tr> <tr> <td>Bocaccio</td> <td>Olive rockfish</td> <td>Urchin (purple and red)</td> </tr> <tr> <td>CA Halibut**</td> <td>Pygmy rockfish</td> <td>Vermillion</td> </tr> <tr> <td>Cabazon**</td> <td>Rock crab</td> <td>White Abalone</td> </tr> <tr> <td>Copper</td> <td>Sheephead**</td> <td></td> </tr> </table> *historically done very well **can tell larvae apart – does not require DNA analysis to identify	Abalone	Cowcod	Squarespot rockfish	Angel sharks	Lingcod	Squid	Blue Rockfish*	Lobster	Swordspine rockfish	Bocaccio	Olive rockfish	Urchin (purple and red)	CA Halibut**	Pygmy rockfish	Vermillion	Cabazon**	Rock crab	White Abalone	Copper	Sheephead**	
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Methods: Catch, measure and age fish, Species dependent timing Change in size with time at liberty information for tagging studies																					
Sites (include name if existing / location / MPA name): These can be used to select 'ideal' sites if all MPAs cannot be monitored. List need to be prioritized. Need a paired experimental design (like areas inside & outside MPA). Well enforced sites Historical and current fishing (inside and outside MPA) Representatives sites within each biogeographic zone Large vs. small reserves (where applicable) Current and past monitoring Exposure (leeward, windward) Habitat type (inside and outside MPA) – depth, substrate, biota																					
Frequency of Monitoring: Initial seasonal baseline for all species inside and out MPA Annually (or more frequently) for fast growing species and those that are recovering or harvested species, Less frequently for slow growing species																					
Program used (if existing, describe if not): (See Table 1 in review of existing programs: Overlap between research programs and Workshop questions for information on existing programs). Ideally have new program that factors in the control variables mentioned above in a paired design. Fisheries dependent program (needs to be geo-referenced and complimented by a fishing method inside the reserve with the same selectivity). Digital catch photos could be used for species identification.																					
Power to detect change: Utilize the results of existing paired pilot studies (e.g., Anacapa, Big Creek, Hopkins, Lobos, etc.) to estimate sample size requirements.																					
Estimated Staff / Funding Required (especially if additional): Difficult to apply funding to one particular question, a well designed program will address several questions.																					

<b>Group: Deep Subtidal</b>
Question/Topic/Goal: <b>Spillover</b> H0 <sub>1</sub> : There is no net movement of adults across boundaries. H0 <sub>2</sub> : There is no net movement of juveniles across boundaries.
Monitoring Activity: Inside and outside MPA tagging required to quantitatively estimate probability of recapture or re-sighting and to control for the effects of the fishing effort. There is expected to be a change in fishing effort due to displacement from reserves.
Data Collected: Acoustic and archival tagging Sight and re-sight Mark and recapture with sport and commercial boats Monitor fishing efforts and CPUE [spatially distributed to capture a gradient from inside MPA (for non lethal fishery) to increasing distances outside MPA (lethal and non lethal)]
Species/Habitat Monitored: Similar habitats - control for biophysical factors Focus on harvested and/or overfished species: Blue Rockfish*                      Lobster Bocaccio                              Rock crab CA Halibut**                      Sheephead** Cabezon**                          Squid Copper                                Urchin (purple and red) Cowcod                                Vermillion Lingcod                                White Abalone *historically done very well **can tell larvae apart – does not require DNA analysis to identify
Methods: Direct visual observations (archived) Acoustic tags and tracking Sighting/Re-sighting for any tagged species; Mark/capture for species that can be released alive Chemical tagging Georeferenced estimates of fishing efforts and CPUE (spatially distributed to capture a gradient from inside MPA (for non lethal fishery) to increasing distances outside MPA (lethal and non lethal)) Species dependent timing
Sites (include name if existing / location / MPA name): These can be used to select 'ideal' sites if all MPAs cannot be monitored. List need to be prioritized. Need a paired experimental design (like areas inside & outside MPA). Well enforced sites Historical and current fishing (inside and outside MPA) Representatives sites within each biogeographic zone Large vs. small reserves (where applicable) Current and past monitoring Exposure (leeward, windward) Habitat type (inside and outside MPA) – depth, substrate, biota
Frequency of Monitoring: Initial baseline inside and outside MPA. At least annually
Program used (if existing, describe if not): (See Table 1 in review of existing programs: Overlap between research programs and Workshop questions for information on existing programs). Ideally have new program that factors in the control variables mentioned above in a paired design (see Species/Habitat section). Historical information.



<b>Group: Deep Subtidal</b>
Question/Topic/Goal: <b>Spillover (Cont.)</b>
<p>Power to detect change:  For estimation of quantitative movement coefficients need to determine sample size requirements (number released, number tagged) based on numbers of recaptures or re-sighting.  For CPUE information use ANOVA design and estimate variance within each experimental cell.  Requires statistical review.</p>
<p>Estimated Staff / Funding Required (especially if additional):  Difficult to apply funding to one particular question, a well designed program will address several questions.</p>

<b>Group: Deep Subtidal</b>																					
Question/Topic/Goal: <b>Species Richness</b> H0 - There is no difference in species diversity inside the MPA, relative to areas adjacent to and distant from the MPA.																					
Monitoring Activity: Visual Observations and photos																					
Data Collected: Species composition Relative abundance Digital photos																					
Species/Habitat Monitored: Combination of random sampling and index areas, both stratified by habitat (see program box below). Similar habitats - control for biophysical factors: <table border="0"> <tr> <td>Abalone</td> <td>Cowcod</td> <td>Squarespot rockfish</td> </tr> <tr> <td>Angel sharks</td> <td>Lingcod</td> <td>Squid</td> </tr> <tr> <td>Blue Rockfish*</td> <td>Lobster</td> <td>Swordspine rockfish</td> </tr> <tr> <td>Bocaccio</td> <td>Olive rockfish</td> <td>Urchin (purple and red)</td> </tr> <tr> <td>CA Halibut**</td> <td>Pygmy rockfish</td> <td>Vermillion</td> </tr> <tr> <td>Cabazon**</td> <td>Rock crab</td> <td>White Abalone</td> </tr> <tr> <td>Copper</td> <td>Sheephead**</td> <td></td> </tr> </table> *historically done very well **can tell larvae apart – does not require DNA analysis to identify	Abalone	Cowcod	Squarespot rockfish	Angel sharks	Lingcod	Squid	Blue Rockfish*	Lobster	Swordspine rockfish	Bocaccio	Olive rockfish	Urchin (purple and red)	CA Halibut**	Pygmy rockfish	Vermillion	Cabazon**	Rock crab	White Abalone	Copper	Sheephead**	
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Methods: Direct visual observations (archived) Drop cameras (baited) Species dependent timing																					
Sites (include name if existing / location / MPA name): These can be used to select 'ideal' sites if all MPAs cannot be monitored. List need to be prioritized. Need a paired experimental design (like areas inside & outside MPA). Well enforced sites Historical and current fishing (inside and outside MPA) Representatives sites within each biogeographic zone Large vs. small reserves (where applicable) Current and past monitoring Exposure (leeward, windward) Habitat type (inside and outside MPA) – depth, substrate, biota																					
Frequency of Monitoring: Initial baseline for all species inside and out MPA Annually.																					
Program used (if existing, describe if not): (See Table 1 in review of existing programs: Overlap between research programs and Workshop questions for information on existing programs). Ideally have new program that factors in the control variables mentioned above in a paired design (see Species/Habitat section).																					
Power to detect change: Utilize the results of existing paired pilot studies (e.g., Anacapa, Big Creek, Hopkins, Lobos, etc.) to estimate sample size requirements.																					
Estimated Staff / Funding Required (especially if additional): Difficult to apply funding to one particular question, a well designed program will address several questions.																					

<b>Group: Trophic Interactions and Ecosystem Structure</b>
Question/Topic/Goal: <b>Brandt's and Pelagic Cormorants</b>
Monitoring Activity: Population trends, Foraging Habitat Use, Productivity, Diet
<p>Data Collected:</p> <p>Carter (BRCO): Aerial photos, no longer funded</p> <p>Gress (BRCO, PECO, BRPE): Annual nesting effort and productivity.</p> <p>NPS (BRCO, PECO): Presence/Absence of Nesting and Roosting Seabirds, Nesting Effort and Success (CORMS, BRPE)</p> <p>Recommend:</p> <p>Paired study in and out of reserves: numbers of individuals, locations, activity</p> <p>Diet study of Brandt's: pick up pellets at end of season (cannot determine within season variation)</p> <p>Monitor boat traffic near breeding sites</p>
Species/Habitat Monitored: Brandt's and Pelagic Cormorants
<p>Methods: Observation on island and from boats during breeding season (ANI), some aerial surveys for BRPE and DCCO (SBI, ANI); Carter: aerial photos of BRCO, DCCO (all CI)</p> <p>Stationary observations from island of bird distribution and boat distribution (habitat use), weekly is optimal, biweekly or monthly could help determine within season variation</p> <p>Diet study: collect pellets at the end of the breeding season, about 50 samples per site; processing time: 1 hr/sample, place in isopropyl, pull out otoliths, learning curve for id (Dan Robinette)</p> <p>Optimal design includes 1 pair of sites per island</p>
<p>Sites (include name if existing / location / MPA name): Existing on ANI, SBI</p> <p>Paired Study for Brandt's Cormorant to look at habitat use (diet study in selected sites near paired study):</p> <p>SMI (Pt. Bennett, Castle Rock, Prince I, NE Shore)</p> <p>SCI (West Pt, Gull Island, E of Painted Cave, Btw/ Scorpion Rock and Chinese Harbor)</p> <p>SRI (Sandy Pt, E of Brockway Pt., Carrington Pt.)</p> <p>SBI NEED TO CHECK</p> <p>Paired study for Pelagic Cormorants to look at habitat use:</p> <p>SMI (Pt. Bennett, Castle Rock, Harris Pt.)</p> <p>SRI (Brockway Pt, E of Brockway Pt., Carrington Pt. Bechers Bay)</p> <p>SCI (San Pedro Pt)</p> <p>SBI (Shag Rock)</p>
Frequency of Monitoring: Gress: 1970-present, except 1995, annual data; Carter: annual (Mar-May) since 1991; NPS: annual (Mar-Sept) since 1985
<p>Estimated Staff / Funding Required (especially if additional):</p> <p>Frank Gress (4-7 trips, 7-10 days, 2 staff for 150 person days), Harry Carter: \$15,000+, NPS: cost not known; cost: staff time, weekly surveys if possible, and boat transport to islands.</p>

<b>Group: Trophic Interactions and Ecosystem Structure</b>
Question/Topic/Goal: <b>Pigeon Guillemot</b>
Monitoring Activity: Population trends, Foraging Habitat Use, Productivity, Diet
Data Collected: Numbers of individuals, locations, activity, diet, survey crevices NPS: abundance and reproductive effort, reproductive success of PIGU (SBI) Carter: population survey (1989-1991) CA Seabird Catalog. Sowles (1980) Hunt et al. 1981. Pigeon Guillemot Foraging
Species/Habitat Monitored: Pigeon Guillemot
Methods: Paired Study for Pigeon Guillemot to look at habitat use (diet study in selected sites near paired study) Boat transects for distribution (probably sufficient); observations for diet; day surveys and/or telemetry, survey crevices for nest contents (egg number, chick growth and survival)
Sites (include name if existing / location / MPA name): SMI (Castle Rock, Harris Pt. Prince I) SCI (West Pt, Painted Cave, Btw/ Painted Cave and Diablo, Scorpion?) SRI (Carrington Pt., Brockway Pt, Bechers Bay) SBI NEED TO CHECK
Frequency of Monitoring: NPS: annual (Mar-July) since 1985., diet study: 2-3 surveys per year and the boat transects, try 1/month during breeding season, survey nest contents at 5-7 day intervals for the breeding season.
Estimated Staff / Funding Required (especially if additional): NPS: cost not known; need observers for diet study (id fish, inverts, and shrimp); two to three 12 hour watches per season. Need to test techniques for boat transects across blocks inside and outside reserve; 1/month during breeding season. Nest Content Surveys (1/wk during breeding season)

<b>Group: Trophic Interactions and Ecosystem Structure</b>
Question/Topic/Goal: <b>Black Oystercatcher</b>
Monitoring Activity: Population trends, Foraging Habitat Use, Need to Check, Diet
Data Collected: Recommend: Survey numbers of individuals, diet, surveys nests Recommend: Paired study in and out of reserves: locations and activity Carter Surveys (1989-1991), CA Seabird Catalog. Sowles (1980), Contact J. Dugan for information, Check Oystercatcher Diet Studies, R? Meese, T. Wootton
Species/Habitat Monitored: Black Oystercatcher
Methods: Breeder's: changes in diet due to changes in intertidal productivity Diet Surveys: find midden and collect shells (gastropods) Population study: spatial use of foraging habitat (paired design) Shoreline transect to survey population size and distribution Nest Surveys: locate nest and eggs, hatching success, chick growth, fledging success survival)
Sites (include name if existing / location / MPA name): Emphasis placed on sites with nests <b>SMI:</b> Pt. Bennett (6 birds), Castle Rock (2 birds), <b>Simonton Cove (5 birds, 1 nest), Harris Pt. (27 birds, 4 nests)</b> , Prince I. (8 birds), Hoffman Pt (4 birds), Bay Pt (1 bird); Cardwell Pt (2 birds), Crook Pt (2 birds) <b>SRI:</b> Sandy Pt (3 birds), North West SRI (2 birds), Brockway Pt (4 birds), Canada Verde (3 birds), Carrington Pt. (4 birds), N Bechers Bay (2 birds), S Bechers Bay (2 birds), Sierra Pablo (2 birds), S Point (5 birds), Bee Rock (1 bird), SW SRI (1 bird) <b>SCI:</b> Fraser Pt (8 birds), West Pt to Diablo Pt (1 bird), <b>Profile Pt (20 birds, 2 nests)</b> , Cueva Valdez (8 birds), <b>Arch Rock to Diablo Pt (7 birds, 1 nest), Diablo Rocks (4 birds, 2 nests)</b> , Fry's to Twin Harbors (6 birds), Spit Rock (4 birds), Pelican Bay (5 birds), Prisoner's Harbor (9 birds), <b>Coches Pt (11 birds, 2 nests)</b> , Cavern Pt (2 birds), Scorpion Anchorage (4 birds), Scorpion Rocks (1 bird), San Pedro Pt (5 birds), Isthmus Pt (5 birds), Valley Anchorage to Coches Prietos Anchorage (5 birds), Bowen Pt (1 bird), Willows (4 birds), Punta Arena (1 bird), Gull I (6 birds), Kinton to Posa Anchorage (2 birds), <b>Black Pt NW (4 birds, 1 nest)</b> <b>ANI:</b> West I (15 birds, 1 nest), Middle (14 birds), East (5 birds) <b>SBI:</b> Shag Rock (2 birds), SBI (16 birds), Sutil I (4 birds).
Frequency of Monitoring: 1/week for nest surveys, 1/mo during breeding for foraging habitat use
Estimated Staff / Funding Required (especially if additional): 1-2 people per island to locate and monitor nests.

<b>Group: Trophic Interactions and Ecosystem Structure</b>
Question/Topic/Goal: <b>Brown Pelican</b>
Monitoring Activity: Population trends, Productivity
Data Collected: Monitor numbers of individuals, locations, activity, boat traffic (night and day) Gress and Henry: pelican breeding success/squid boat interaction (in prep)
Species/Habitat Monitored: Brown Pelican
Methods: Observation on island and from boats during breeding season (ANI), some aerial surveys for BRPE and DCCO (SBI, ANI)
Sites (include name if existing / location / MPA name): Existing on ANI, SBI Recommend: More detailed nesting information from SBI (See Gress, Martin).
Frequency of Monitoring: Gress: 1970-present, except 1995, annual data; NPS: annual (Mar-Sept) since 1985; Gress, Henry: 1999-present?.
Estimated Staff / Funding Required (especially if additional): Frank Gress (4-7 trips, 7-10 days, 2 staff for 150 person days); NPS; Gress, Henry: short term study to result in policy change re: light boat use. Existing DFG data may help determine change in potential impact from light boat use, but is limited in scope (only 22 useable data points). This study could be expanded on.

<b>Group: Trophic Interactions and Ecosystem Structure</b>
Question/Topic/Goal: <b>Shorebirds</b>
Monitoring Activity: Indirect effect of protection through changes in kelp forest productivity in reserve areas
Data Collected: location, activity, nesting success (SNPL)
Species/Habitat Monitored: Snowy Plover Willet Godwit Sanderling
Methods: Paired study of foraging habitat use in and out of reserve. Scan and focal-animal sampling.  See also: Comparison of wader and shorebird communities and water quality indices in restored and less disturbed, reference salt marshes of Southern California /by Lisa Dobson Snyder
Sites (include name if existing / location / MPA name): SMI (Simonton Cove-in and out, Cuyler Harbor-out) SRI (Becher's Bay-out), Skunk Pt.-in) SCI (Gull Island-in and out)
Frequency of Monitoring: Gress: 1 per week
Estimated Staff / Funding Required (especially if additional): 1 person to cover all sites 1/week

<b>Group: Trophic Interactions and Ecosystem Structure</b>
Question/Topic/Goal: <b>Cassin's Auklet (Low Priority)</b>
Monitoring Activity: Population trends, Productivity
Data Collected: survey population (individuals and nests, #eggs, hatching success, fledging success) and boat traffic in and out of reserve (SMI)--consider different types of disturbance
Species/Habitat Monitored: Cassin's Auklet
Methods: Josh Adams: Annual nesting effort and productivity (SMI), telemetry to determine colony foraging ranges (Prince I, Scorpion), diet collections (euphausiids and larval fishes) Harry Carter: 1989-1991 Population survey (?), telemetry to determine at-sea distribution Boat and shore surveys (day or night survey?)
Sites (include name if existing / location / MPA name): SMI (Prince I, Castle Rock) SCI (Gull I, Diablo Pt (boat survey), Scorpion Pt.) SBI, Sutil I. NPS: SMI (Prince I, Castle Rock) SCI (Gull I, Diablo Pt (boat survey), Scorpion Pt.) SBI, Sutil I
Frequency of Monitoring: 1/wk during breeding season
Estimated Staff / Funding Required (especially if additional): staff to monitor colony and nesting (not distribution at sea)



<b>Group: Trophic Interactions and Ecosystem Structure</b>
Question/Topic/Goal: <b>Southern Sea Otter (If Applicable)</b>
Monitoring Activity: Population trends, Foraging Habitat Use, Diet
Data Collected: population survey, distribution, dispersal, fecundity, mortality, survivorship, diet
Species/Habitat Monitored: Southern Sea Otter
Methods: boat and shore surveys of otter populations, paired sites observation of numbers and location (foraging habitat use), timed observation of foraging behavior (diet) Before arrival of otter: surveys of kelp forest community structure
Sites (include name if existing / location / MPA name): To be determined at a later date (when and if sea otters inhabit CINMS)
Frequency of Monitoring: 1/mo survey
Estimated Staff / Funding Required (especially if additional): Unknown

<b>Group: Trophic Interactions and Ecosystem Structure</b>
<b>Question/Topic/Goal: At-sea density of California sea lions, other marine mammals, and seabirds in and outside MPAs within CINMS</b>
Monitoring Activity: Line or strip transect within Channel Islands National Marine Sanctuary
Data Collected: Ship transect surveys of marine mammals which included CINMS by NMFS/SWFSC have been collected in the past, but sea lions near rookeries and islands were not recorded.
Species/Habitat Monitored: California sea lion (including other marine mammals and seabirds). All MPAs and waters within CINMS.
<p>Methods:</p> <p>Line or strip transect study utilizing small boat, aircraft, or both.</p> <p>Stratified design to include ship or aircraft surveys, and difference in surface areas of MPAs and areas outside MPAs.</p> <p>Densities of sea lions, other marine mammals, and seabirds will be compared between areas inside MPAs and those outside MPAs through time (null hypothesis to be tested: there is no difference in densities of sea lions, other marine mammals, and seabirds between MPAs and outside MPAs through time).</p>
<p>Sites</p> <p>CINMS waters: Transect lines will include MPAs and all areas outside MPAs.</p>
Frequency of Monitoring: Seasonally (monthly ?)
<p>Estimated Staff / Funding Required (especially if additional):</p> <p>Cost will be determined after experimental design is completed (cost will depend on frequency of surveys [monthly, seasonally], distance covered by transect lines, and platform).</p> <p>\$50,000 to \$150,000. Number of personnel will depend on survey platform and design.</p>

<b>Group: Trophic Interactions and Ecosystem Structure</b>
Question/Topic/Goal: <b>Harbor Seal</b>
Monitoring Activity: Population trends, Foraging Habitat Use, Diet
Data Collected: Population survey, Diet data from scat
Species/Habitat Monitored: Harbor Seal
<p>Methods: NMFS-SWFSC 2002 Aerial census during molt (end of May): Maximum number hauled out on land (Lowry) Need quiet plane (Partenavia P68/Observer Model)</p> <p>DFG 1982-present. Annual aerial survey during the molt. (Ongoing, \$4,000-5,000)</p> <p>How many individuals and distribution; identifies haul out regions (Read, ongoing \$10,000). Covers entire region. NMFS-NMML 1968-present, San Miguel Island, Population size, diet (sea lions), disease assessment, vital rate assessment, environmental pollutants (DeLong, ongoing, \$100,000-150,000 for all pinnipeds at SMI).</p>
<p>Sites (include name if existing / location / MPA name):</p> <p>Haul out locations in and out of reserve: aerial observations (already done)</p> <p>Paired studies (not necessary to cover all islands): input haulout site locations, select sites with haulouts, without haulouts,</p> <p>Haulout Sites (SMI) Consider Sea Lions! Add sites at SCI:</p> <p>Inside: Harris Pt (Harbor Seal Coves), Hoffman Cove</p> <p>Outside: Otter Pt., Crook Pt.</p> <p>Recommend: Collect scat at each site to determine diet</p> <p>Recommend: Foraging in and out of reserve: cannot track individuals without satellite tags, radio telemetry, expensive. CODAR?</p>
Frequency of Monitoring: Seasonal
<p>Estimated Staff / Funding Required (especially if additional):</p> <p>Possible from other studies, unknown.</p>

<b>Group: Habitat Mapping and Characterization</b>
<b>Question/Topic/Goal:</b> Standardize a hierarchical intertidal, subtidal, and pelagic marine classification system for the Channel Islands. This classification structure should be applicable to the California coastal environment and ultimately across the entire eastern Pacific ecoregions.
<b>Monitoring Activity:</b> N/A
<b>Data Collected:</b> All existing classification systems from the Eastern Pacific: Greene et al., Zacharias, Dethier (WA), NOAA/NatureServe, Shorezone (AL), Shaffer et al. (CDFG), etc.
<b>Species/Habitat Monitored:</b> N/A
<b>Methods:</b> Review of Data Sources Review of Classifications Integration of Classifications Verification / Pilot Test Peer Review / Workshop Final Report
<b>Sites (include name if existing / location / MPA name):</b> The classification will be relevant to the entire Southern Bight and expandable along the CA coast and ultimately to the eastern North-Pacific.
<b>Frequency of Monitoring:</b> N/A
<b>Program used (if existing, describe if not):</b> Build on existing programs elsewhere
<b>Power to detect change:</b> Classification will be predictive, transparent, and transportable
<b>Estimated Staff / Funding Required (especially if additional):</b> \$ 7,000 for short term staff support (6-8 weeks) \$10,000 for workshops for peer review and federal review \$2,500 time for web development and publication

<b>Group: Habitat Mapping and Characterization</b>
Question/Topic/Goal: Collect and compile existing physical oceanographic data set to integrate into a GIS layer. These data sets will incorporate into a habitat classification system.
Monitoring Activity: N/A
Data Collected from existing institutions and monitoring programs: Sea surface temperature, bottom temperature, current, nutrient, dissolved oxygen, terrestrial runoff, photic, turbidity, salinity, substrate, depth, wave exposure, water mass properties
Species/Habitat Monitored: All
Methods: Most of these are existing data that can be retrieved from existing programs, (Scripps, UCSB, etc.). Data will need to be cleaned and projected into GIS.
Sites (include name if existing / location / MPA name): Entire Channel Islands area.
Frequency of Monitoring: Will depend on the data set.
Program used (if existing, describe if not): To be developed
Power to detect change: Variable
Estimated Staff / Funding Required (especially if additional): To be determined

<b>Group: Habitat Mapping and Characterization</b>
Question/Topic/Goal: What are the mapping priorities (location, scale)? <b>Multibeam sonar mapping</b> of the entire island environment at 1 meter resolution out to 3 miles. Possibly, the deeper levels can accept coarser mapping resolution, but it is not recommended by the pelagic groups.
Monitoring Activity: Substrate Mapping
Data Collected: Multibeam sonar and backscatter at the minimum of 10 meter resolution, preferably 1 meter. Scripps models MMS data
Species/Habitat Monitored: Map entire island habitats to 3 miles. Regular re-mapping required for areas of high seasonal changes.
Methods: Multibeam sonar mapping.
Sites (include name if existing / location / MPA name): All habitats within 3 miles of all islands.
Frequency of Monitoring: One time, but may change to represent seasonal variability of sand movement. Approximately 1 field season (3-4 months for initial priority mapping inside and near MPAs)
Program used (if existing, describe if not): N/A
Power to detect change: N/A
Estimated Staff / Funding Required (especially if additional): To be determined.

## Social and Economic Monitoring

<b>Group: Non-User Values</b>
Question/Topic/Goal: <b>Economic Impact of MPAs</b> What is the economic impact of MPAs to non-users?
Monitoring Activity: Monitoring the socio-economic impact of reserves on non-users
Justification: <p>The greatest potential socio-economic benefit of reserves is to the millions of non-users who value preserving healthy ecosystems for their intrinsic worth, and who will perceive the main value of reserves as a means to repair the degradation of marine life by human impacts. The implementation of the reserves will make an enormous cohort across the US, and across the world, feel that the stewards of ocean resources are moving to safeguard marine ecosystems, which are widely recognized as a vital part of the web of life on earth.</p> <p>Socio-economic monitoring should be prioritized to evaluate impacts in order of their importance. As stated on p. 25 of the Socio-Economic Workshop Materials handout, non-users are “potentially the largest benefit category of marine reserves”. It would be a serious oversight for the socio-economic monitoring program to ignore this far-reaching benefit. Without explicit consideration of non-user socio-economic benefits, it will not be possible to draw valid conclusions on the reserves’ impact.</p> <p>In summary, engaging the expertise needed to conduct a defensible, ongoing survey of non-user value of reserves should be a top priority of the socio-economic monitoring program.</p>
Data Collected: <p>Measure non-user benefits of reserves through non-user panels and surveys. These should be national in scope and ideally would have an international component. Benefits to non-users will accrue over time as knowledge of the reserves spreads, so this evaluation should take place yearly. These non-user panels and surveys should be designed in conjunction with education efforts about the reserves.</p> <ul style="list-style-type: none"> <li>• Ask all professional image takers (photographers, videographers, film-makers, network and cable TV, internet) who record images in the reserves and elsewhere in the CINMS to assist in tracking broadcasts, webcasts, public exhibitions and sales of their work to non-users (i.e., at distances &gt;100 miles from Reserves).</li> <li>• Track purchase and use of educational materials arising from reserves by non-users.</li> </ul> <ol style="list-style-type: none"> <li>1. Begin with non-consumptive users as a demographic subgroup (expected largest beneficiaries), in conjunction with surveys of non-consumptive users.</li> <li>2. Establish the study area as the local project area, similar to any survey of non-consumptive users.</li> <li>3. Utilize a contingent valuation method for the survey, with in-person interviews.</li> <li>4. If funding permits, begin assessing nonuse value for the public at large, expanding the scope / area of the study in concentric circles from the Santa Barbara area.</li> <li>5. Follow protocols from NOAA, with best standards developed since then (refer to Hall, Hall and Murray, 2002: Natural Resource Modeling Vol. 15 No 3).</li> <li>6. A longer term, less expensive survey should be utilized, in order to more accurately assess the valuation as well as changes to the valuation over time as marine reserves begin restoring health of the environment (\$25-50k / yr). The 5 year time frame is important as it ties to improvements of ecosystem richness of marine reserves.</li> </ol>
Spatial Resolution/Scope: Summary information on marine ecosystems within the different reserve areas, and in both adjacent and remote areas of similar size, would probably be sufficient.
Cost: \$25,000-\$50,000 per year

<b>Group: Non-User Values</b>
Question/Topic/Goal: <b>Economic Impact of MPAs</b> What is the economic impact of MPAs to non-users? (Cont.)
Staff: One FTE could overlap with education/outreach mission You might be able to use volunteers, if well trained by the Principal Investigator. You would also have to test for interviewer effects of those who have undergone training.
Funding Sources: Private foundations concerned with the health of the marine environment Conduct interviews as part of a larger survey of non-consumptive users in order to reduce costs



Group: Non-User Values
<p>Question/Topic/Goal: <b>Value of MPAs</b></p> <p>Study will measure the values of reserves to non-users.</p>
<p>Monitoring Activity:</p> <p>Monitoring the socio-economic impact of reserves on non-users (new data collection)</p>
<p>Justification:</p> <p>In order to accurately assess the economic costs and benefits of marine reserves in the CNIMS, value of non-use must be included. Non-users were identified as potentially the group to benefit the greatest by the socioeconomic panel of the MRWG, as stated on page 25 of "What We Know". The SAC also recognized the need for data on this group. Stakeholders are included as an integral part of the MLPA, and as the law indicates that they need to be included in that process, then they should be included in this one. We recognize that funding limitations would prevent the study from including the general public; however the exclusion of all those with non-use values would significantly underestimates the total value and excludes the greatest benefits to the largest group.</p> <p>This survey could potentially be included as part of a larger survey looking at user groups (both consumptive and non-consumptive). This could end up being much cheaper than two separate surveys.</p> <p>The Discovery Channel and National Geographic TV both cater to the "non-use" category of the population-people who may never go to where ever the show is featuring, but are still intrigued and care very much just the same. We CANNOT discount them, nor close their voice out of the process.</p> <p>Additionally, the resources protected by the marine reserve system are a national resource and limiting the process to only those who use the resource skews the priorities of how the resources should be allocated.</p>
<p>Data Collected:</p> <p>Sample: Those who hold non-use values.</p> <p>Begin with a sample of people to be surveyed, so that this survey can be performed in conjunction an existing survey.</p> <p>Establish the study area as the system of marine reserves for which the monitoring program will be established.</p> <p>Utilize a contingent valuation method for the survey, with in-person interviews.</p> <p>If funding permits, begin assessing nonuse value for the public at large, expanding the scope / area of the study from the Santa Barbara/Ventura area.</p> <p>Follow protocols from NOAA, with best standards developed since then.</p> <p>In order to obtain trends in non-use value over time, perform a smaller survey with shorter periods.</p>
<p>Timing:</p> <p>Initial study will take two years to develop and should be conducted every three years.</p>
<p>Spatial Resolution/Scope:</p> <p>Values estimated should not be broken down geographically. The scope should be the set of Channel Islands Marine Reserves.</p>
Cost: Greater than \$100,000
<p>Staff: 1-2 FTEs.</p> <p>Volunteers could be trained to help conduct survey interviews, thus cutting agency costs. In the vicinity of the study area there are multiple universities and NGOs from which volunteers could be chosen. Students could aid in surveys as part of class work.</p>
<p>Funding Sources: Matching funds could be requested from private foundations, coastal communities, local businesses, etc. Cost-sharing by multiple agencies should be encouraged. Private donations/fundraiser events could help, too.</p>

<b>Group: Recreational Users</b>
<p><b>Question/Topic/Goal: Use, Catch and Value</b></p> <p>How does consumptive recreational boater activities including use and catch patterns (e.g. effort, location, mix of kept/release) change over time with respect to loss of access, biological changes and consequences, availability/attractiveness of alternatives, long-term benefits and costs, socioeconomic and demographic changes, and management changes compared to the baseline without reserves? This question would include long-term value estimation for Option Values - regarding the option to fish at the Islands, Bequest Values - for the future ability to fish, and Existence Values - for the knowledge that fishing does occur (all related to, but not the same as non-user values which have similar benefits).</p>
<p><b>Monitoring Activity:</b></p> <p>Compiling existing and collecting new data. See Bennett study of log book data.</p>
<p><b>Justification:</b></p> <p>We need to know how consumptive recreational boater activities have changed to understand the benefits and impacts of marine reserves.</p>
<p><b>Data Collected:</b></p> <p>On-site interviews (including detailed location information) - need to incorporate sampling of private access boats; Off-site sampling (surveys/interviews (phone, mail, with license sale) to determine proportion of population and characteristics. Aerial surveys (e.g. number, activity (including type of vessel) around Channel Islands). Volunteers: senior volunteers, recreational fishermen, clubs/tournaments. Incorporate latest technology - GPS, data loggers.</p>
<p><b>Timing:</b></p> <p>3 months from collection to product Data collection could range from daily to biannual or longer</p>
<p><b>Spatial Resolution/Scope:</b></p> <p>1X1 nm</p>
<p><b>Cost:</b></p> <p>&gt;\$100,000</p>
<p><b>Staff:</b></p> <p>5 Full Time Employees, could be volunteers Volunteers would be used to obtain use and catch information as described earlier. Volunteers would require extensive training and oversight. Club/tournament volunteers may provide non-random sampling information with potential bias.</p>
<p><b>Funding Sources:</b></p> <p>Federal (Leeworthy); State; In-kind services; NGO</p>

<b>Group: Recreational Users - Consumptive</b>
<b>Question/Topic/Goal: Edge Effects</b> Separate edge effect from other fishery management activities.
<b>Monitoring Activity:</b> Data collection, tagging program, sample fishing program, surveys
<b>Justification:</b> Can't understand the benefits and impacts without measuring this use.
<b>Data Collected:</b> Type of data collection <ul style="list-style-type: none"> <li>• New data collection (survey data), [for incorporation into new improved MRFSS and other state data] number, size, length, weight, GPS location.</li> <li>• Cooperative professional recreational sustainable fishery organizers. leading special data collection efforts from recreational community.</li> <li>• Tagging programs for catch and release.</li> <li>• Possible reinterpretation of existing fishing data (tournaments) e.g. marlin,</li> </ul> Type of information <ul style="list-style-type: none"> <li>• Profiles of users/recreational activity, geographical location, # of people, catch details, time spent, CPUE, size, demographics, quality of the experience, season, expenditures</li> </ul> How to obtain measurement <ul style="list-style-type: none"> <li>• Select group of recreational fishermen</li> <li>• GPS handhelds</li> <li>• Palm pilots</li> <li>• Measuring tape</li> <li>• Scales</li> <li>• Release tools</li> <li>• Training by private/public coalition</li> </ul>
<b>Timing:</b> 7 year project. Year 0 important now. Align frequency with biological surveys.
<b>Spatial Resolution/Scope:</b> As fine as can be reported (but not an enforcement tool) Broad reaching throughout CINMS region to create momentum.
<b>Cost:</b> Training recreational fishery coordinators, Kits, Stipends
<b>Staff:</b> Data collection/analysis expert, Paraprofessional organizers from recreational community, Volunteer efforts.
<b>Funding Sources:</b> SFRA Funds Sustainable fishery organizer grants

<b>Group: Recreational Users - Private and For Hire Operations</b>
<b>Question/Topic/Goal: Edge Effects</b> Monitor edge effects (spatial distribution) for private and for-hire boats, both angling and diving consumptive users.
<b>Monitoring Activity:</b> New data collection
<b>Justification:</b> To measure potential congestive edge effects of each reserve site. Replicated every few years to measure serial changes.
<b>Data Collected:</b> Observers on-board charters including dive boats with GPS. Dockside interviews with private boats at public access sites with detailed maps. Interviews of 'private access' private boats by intercept by, water (boat) or private access marina based observers, both with detailed maps. Island land based (or aerial, less desirable) surveys of distribution of vessels around the reserves, observation only no intercept dawn to dusk usage patterns. Collection of user phone numbers for follow-up economic issues.  Type of information: catch, value, activity, edge effect, profile of users, recreation/tourist spending, knowledge attitudes and perceptions, spatial distributions, cost and earnings, other regulations effect, oceanographic, weather, annual metadata.
<b>Timing:</b> Fifteen months with a period of three years.
<b>Spatial Resolution/Scope:</b> 1x1 minute resolution
<b>Cost:</b> \$300,000
<b>Staff:</b> Three FTEs and one volunteer. 10 volunteers for observers on board charters and for intercepting boats in harbors and ramps. 2 FTE for 4 months of island observations and 8 months of data processing. 1 FTE 12 months of volunteer coordinator and general oversight.
<b>Funding Sources:</b> NOAA funded, CDFG funded, Congressional Line item, NPS funded, misc. grants? Need 100K/year sustained.

<b>Group: Recreational Users (Consumptive and Non-Consumptive)</b>
Question/Topic/Goal: <b>Attitudes and Perceptions</b>
Surveying recreational users on knowledge, perceptions and attitudes, over time, related to MPAs in CINMS
Monitoring Activity: collecting new data
Justification: Important feedback to management including revelation of misinformation, to determine from where users obtain information, the levels of awareness and understanding, needs for outreach, education and adaptive management, public response MRWG, goals/objectives, important feedback to wider fishery management, development of the necessary relationships for data acquisition for users, the hypothesis-driven, defensible research.
Data Collected: <ol style="list-style-type: none"> <li>1. Transparent process for survey design</li> <li>2. Intercept surveys</li> <li>3. Visitor surveys to tourists on charter boats</li> <li>4. telephone surveys to get appropriate sample of use survey respondents</li> <li>5. In person interviews (field surveys) (surveys have to be independently distributed by independent institutions (i.e. university))</li> <li>6. Consider multi-language issues</li> <li>7. use volunteers where possible</li> </ol> How to Obtain: <ol style="list-style-type: none"> <li>1. Transparent process for survey design (charter/party boat operators)</li> <li>2. Intercept surveys (Visitors on charter/party boats)</li> <li>3. Visitor surveys to tourists on charter boats (private boaters including those who have not yet visited channel islands)</li> <li>4. telephone surveys to get appropriate sample of use survey respondents (licensees)</li> <li>5. In person interviews (field surveys) (surveys have to be independently distributed by independent institutions (i.e. university)) (but restricted to cost control, corrections to avidity (control for frequency of use bias)</li> <li>6. Consider multi-language issues (surveys on potential users)</li> <li>7. use volunteers where possible</li> </ol>
Timing: 15 months from collection to compilation Annual depending on when MPA changes
Spatial Resolution/Scope: N/A
Cost: >\$100,000
Staff: 2 Full Time Employees, could be volunteers Sources of volunteers: i.e. NOAA, and Naturalist Corps volunteers use of volunteers: to administer surveys, database entry, public relations.
Funding Sources: SEA GRANT, S/K, and other NOAA grants. Funded out of Sanctuary budget?

<b>Group: Non-Consumptive</b>
Question/Topic/Goal: <b>Value of Reserves</b>
Monitoring Activity: collecting new data
<p>Justification:</p> <ul style="list-style-type: none"> <li>*Assure that the benefits to non-consumptive users exist and quantify/describe those benefits.</li> <li>*Non-consumptive benefits are a necessary element to Cost Benefit Analysis.</li> <li>*It is essential to capture market and non-market value to know the positive economic impact to the user and community.</li> <li>*To document change of perception and actions of users and non-users regarding marine reserves over time.</li> <li>*The value of non-consumptive users is rapidly approaching or has already exceeded that of consumptive users. Therefore it is imperative to give the non-consumptive users equal consideration. How to measure the value of stewardship/pride in the Channel Islands?</li> </ul> <p>We feel that the value of non-consumptive use is just as valuable, if not more valuable, than the value of consumptive use.</p>
<p>Data Collected:</p> <p>SURVEY: Utilize clubs/organizations &amp; volunteers for in-person survey of users. In person surveying is best, though if there are constraints on this kind of survey, we need to be flexible and allow for other methods: phone; electronic (email/web); direct mail. In person surveys could take place on: charter, party, and concessionaire (IPCO) boats or at landings. Additionally, in person surveys could be implemented on-site using private and government vessels (CG, CDFG, CINMS, CINPS, Channelkeeper, and others). This could be a core opportunity for commercial fishers to become involved in the education and economic monitoring process. Docks, harbors, etc. are excellent examples of locations where trained surveyors and existing programs (i.e., Dock walkers) could be dispatched for gathering of data. Survey forms could be made available at a variety of locations: stores where fishing licenses are sold; dive shops where equipment is rented/sold and tanks are filled; boating supply store (West Marine, Chandlery, etc.); outdoor supply store, etc. These written surveys do not need to be as extensive/elaborate as the in-person surveys but certainly could assist in establishing use patterns and baseline data. Program surveyors will be trained using established protocols and methodology. We recognize that activities at the Channel Islands have seasonal variation and this needs to be taken into account when choosing when to survey and how frequently they are conducted. It is important to implement into this survey the changes in use-patterns which may accompany the establishment and growth of marine protected areas in the Channel Islands.</p>
<p>Timing: 12 months from collection to compilation</p> <p>Annual surveys taking into account seasonal variations</p>
Spatial Resolution/Scope: N/A
Cost: \$40,000
<p>Staff: 1 Full Time Employees, could be volunteers</p> <p>Potential sources of surveyors: NGOs, Naturalist Corps, , CINMS, interns from UCSB/CSUCI/CSLB/SBCC/VC</p>
<p>Funding Sources:</p> <p>Partial or matching funding could also be obtained from: NGOs; Chambers of Commerce; Local foundations. Match donations could take the form of: copy services; office supplies; transportation; people's time; advertising/marketing in local papers and TV; web design. Benefit fundraising event (i.e., Sanctuary Foundation) could augment the existing government funding and serve as a tool for education and outreach while fostering a sense of ownership for the user public.</p>

<b>Group: Non-Consumptive</b>
Question/Topic/Goal: <b>Use In Reserves</b>
Monitoring Activity: Collecting new data
<p>Justification:</p> <p>Non-consumptive users are key stakeholders in the CINMS and potentially major beneficiaries from the establishment of marine reserves. Non-consumptive user activities have substantial socioeconomic impacts in the CINMS, and these economic benefits are expected to increase due to the establishment of marine reserves. Over the long term, the economic benefits from non-consumptive users may exceed the existing benefits of some consumptive users, especially in light of the existing economic value of these activities and the underestimation of these benefits by the exclusion of private boat non-consumptive recreational users (as identified on page 13 of Leeworthy &amp; Wiley, 2002). [NOTE: the exclusion of nonuse values may significantly underestimate the benefits of marine reserves (see page 25 of socioeconomic monitoring handout)] This is particularly true for secondary economic benefits/multiplier effects to government and local economies of non-consumptive users, e.g. boat purchases, SCUBA gear, restaurant / hotel expenditures, etc. Therefore, the impact of the marine reserves on the value of non-consumptive activities must have a well-established baseline and must be accurately monitored over time. This is necessary in order for management to make well-informed decisions for the benefit of all stakeholders. As part of this endeavor, it is important to identify the change in benefits to the different non-consumptive user groups, including skin/SCUBA divers, slip / private boaters, photographers, whale watchers, island visitors, snorkelers, etc. It is also important to monitor the change in value of each of these individual user groups due to implementation of marine reserves.</p>
<p>Data Collected:</p> <ol style="list-style-type: none"> <li>1. Identify / stratify non-consumptive user groups and prioritize user groups for data collection based on funding constraints.</li> <li>2. Identify the study area (within the Sanctuary, areas inside and outside of marine reserves, and outside the Sanctuary).</li> <li>3. Design a contingent valuation survey to estimate the use and nonuse values to these users from the establishment of marine reserves. The survey should include an estimation of willingness to pay (WTP) of the different non-consumptive user groups to utilize the marine reserves</li> <li>4. Follow established federal protocols (15 CFR Chapter IX, as further discussed in Mitchell &amp; Carson, "Using Surveys to Value Public Goods: The Contingent Valuation Method").</li> <li>5. Conduct in-person surveys of all users of charter boats/concessionaires, and then stratify by user group. Utilize a telephone survey methodology of non-consumptive users that do not utilize charter boat/concessionaires to reach the islands (private boats, stratified by distance of the boat slip to the islands).</li> <li>6. Utilize/incorporate existing grey literature / data (such as dive logbooks from existing users such as the concessionaires</li> <li>7. If possible, utilize non-profit organizations (such as Channelkeeper), graduate students, the Sanctuary's volunteer corps, etc. to implement the surveys.</li> <li>8. Implement the survey on a seasonal basis in order to account for seasonal use variations.</li> <li>9. Analyze results and publish/share results with decision makers, stakeholders, and the public. [NOTE: because charterboat/concessionaires take both consumptive and non-consumptive users to the CINMS, the survey activity of these two user groups should be coordinated in order to save costs.]</li> </ol>
Timing: Daily survey over 3-4 weeks each quarter
Spatial Resolution/Scope: N/A
Cost: >\$100,000
Staff: 0 Full Time Employees, could be volunteers Sanctuary docents/volunteers, NGO volunteers, and students (at low cost) can help carry out the surveys.
Funding Sources: NGOs and concessionaires could provide in-kind donations of travel to the islands. Local foundations could donate funds. Seek funding from the SB Chamber of Commerce (to accurately assess economic benefits).

<b>Group: Recreational Users - Non-Consumptive for Hire Operations</b>
Question/Topic/Goal: <b>Use in Reserves</b> Economic Costs, earnings of non consumptive recreational use of for hire operations.
Monitoring Activity: New data collection
Justification: FOR HIRE 1) What is the economic impact of reserves 2) SAC ranked this as a top priority 3) Must have these data to validate claims of impact 4) This will show the equity (share the pain) of impacts/benefits 5) To see the relative changes in non/consumptive uses and business 6) The correlation of health of ecosystem on these business operations 7) This is the pilot study for other proposals viability
Data Collected: Monitor costs earnings investments over time for recreational business use (the 51 users previously identified) of the for hire consumptive and non-consumptive groups. Determines an element of net national impact of reserves.  1) Representative panel surveys over time starting with the 1999 survey. Include logbook data for # passengers etc. to determine changes in customer base and operations. Note that other factors beyond MPAs must be considered for changes between 1999 and 2003. 2) Survey of new entrants and those who exit form this user group. 3) Track numbers of operators in the business by category over time. 4) Panel surveys of control populations up to 100 miles away. 5) Consider the use of electronic data gathering means, Personal Digital Assistants (PDA), GPS, and Computers with possible value added benefit to the user, i.e. fuel usage, catch, anglers, etc.
Timing: Three months with annual period.
Spatial Resolution/Scope: 1x1 minute resolution
Cost: \$10,000 - \$25,000 COST -(20K\$ first year, 11K thereafter, software development, hardware costs unknown)
Staff: FTE = 3 person months for 51 interviews. Unknown amount of FTE for software development for PDA/Personal Computer functions. Confidential data needs to be collected by staff person, not volunteer.
Funding Sources: Grants for economic impacts, local community, state, federal. SK grants, NPS monitoring budget, concession fees, NP entrance fees, NP enforcement fines.



<b>Group: Commercial Fishing</b>
<p>Question/Topic/Goal: <b>Monitor Use, Catch, Value using existing data at 10x10 scale</b></p> <p>Basic/Practical/Existing Data Compilation and Analysis - Compile and analyze data on the following: species groups (need to fine tune list of 14 species - take sea bass out of 12 and make separate; make halibut separate from 7, and add salmon), gear, port, region, vessel size, portfolio effect (this refers to multi-fishery fishermen), market availability and price. These data need to be correlated with environmental information (from fishermen's knowledge and biological monitoring) and regulatory changes. From all of this, we want to establish baseline data, and track changes after MPAs go into effect. The data should be available in a database which can be queried to analyze a variety of relationships among the different data sets, and all data should be geo-referenced (for GIS). Each dataset should be as complete as possible - back as far as agency has been collecting data.</p>
<p>Monitoring Activity: collecting new data, modeling and analysis</p>
<p>Justification:</p> <p>This is the most important and only basic information that needs to be established and collected annually to assess effects of MPAs at a large scale.</p> <p>These data are necessary to track regional trends and effects, separate from local events. This is extremely useful information at a minimal cost.</p>
<p>Data Collected:</p> <p>All of the data are collected routinely by a variety of agencies already. This monitoring initiative involves compiling and analyzing these data. Before this can be done there needs to be system created which accommodates confidentiality issues relating to fishermen's proprietary knowledge, if these data include anything higher resolution than 10 x 10 mile. Steps include: designing protocol for confidentiality issues, making arrangements with various agencies to transfer datasets to this project director's office on a regular basis, performing analyses, preparing reports to disseminate results.</p>
<p>Timing:</p> <p>Estimated 1 month to get data transfer and analysis mechanism up and running (2 weeks to get data from CDFG for example, and 2 weeks to process). Then 1 month per year to create annual report. One month to collect the data. Data collected annually.</p>
<p>Spatial Resolution/Scope: 10x10 minute blocks</p>
<p>Cost: \$1,000 - \$10,000</p>
<p>Staff: &lt;1 FTE.</p> <p>Only requires a full time employee for approx. 1 month per year. Confidentiality needs to be ensured through data encryption to ensure confidentiality. It is imperative that this employee be skilled in statistical analysis, and has experience in writing computer code to analyze data such as in SAS and SPSS. Employee also needs to be skilled in GIS (ArcView is the standard).</p>
<p>Funding Sources: PSMFC, Saltonstall-Kennedy, SeaGrant, Fishing Organizations</p>

<b>Group: Commercial Fishing</b>
<b>Question/Topic/Goal: Use/Catch and Value</b> Above Monitoring Enhanced (1x1 mi or so). Detailed, fishery specific measurement of change in fishing activities and their social and economic consequences.
<b>Monitoring Activity:</b> collecting new data
<b>Justification:</b> There is a critical lack of comprehensive, relevant social and economic data for most fisheries. These data are necessary to fulfill the socio-economic goals and objectives specified by the MRWG and the SAC and approved by the Fish and Game Commission. The data also help fulfill some regulatory requirements for future regulations. In contrast to biological research at the Islands, little social science research has been done. There is a cumulative, 25-year record of biological research; social science research has only recently begun, and has been piecemeal and insufficient. Moreover, there is a critical lack of infrastructure to support the needed social science research and its meaningful integration into the management and policy processes.
<b>Data Collected:</b> 1. Establish fishermen's data committees to collaboratively develop infrastructure for collaborative fisheries research including tools, methods and protocols 2. Extract relevant baseline data (from S1A Basic) and synthesize other quantitative and qualitative data 3. Use ethnography to collect and analyze local knowledge (e.g., fishermen's experiential knowledge), including interpretation of logbook and other existing data 4. Train fishermen and scientists in the use on-the-water data collection technology 5. Determine gaps in social and economic baseline data and conduct surveys and /or ethnographic research to fill those gaps 6. Use rapid assessment or other techniques to map social and economic networks 7. Analyze data to determine the spatial and temporal distribution of positive and negative impacts on commercial fisheries and associated communities.  Note: Type of measurement/activity: requires both data collection and synthesis AND analysis. Type of data collection: involves new data collection, building upon compilation and synthesis of existing data.
<b>Timing:</b> 36 months, annual reporting.
<b>Spatial Resolution/Scope:</b> 1x1 minute blocks - at a minimum, in some cases the resolution may need to be finer.
<b>Cost:</b> \$1,500,000
<b>Staff:</b> 8 FTEs, 1 Volunteer. Potential community members and/or student interns (only if well trained, carefully supervised and approved by fishermen's data committee). Fishermen's time and input (partially compensated, partially donated).
<b>Funding Sources:</b> PMCC/IFR collaborative research program; PSMFC collaborative research RFP; Saltonstall-Kennedy Grant Program; Packard Foundation (?) and other foundations; Sea Grant; Fishing associations; EDD grants for skills development/technical training.

<b>Group: Commercial Fishing</b>
<p>Question/Topic/Goal: <b>Edge Effect</b></p> <ol style="list-style-type: none"> <li>1. Are people fishing the boundary or 'edge' of a reserve and what are they fishing for?</li> <li>2. Is there crowding on the edge of the reserve?</li> <li>3. What are the economic benefits and/or costs of fishing the edge of the reserve? Key to answering these questions is identifying what is considered the 'edge' of a reserve (i.e., 200 feet of the regulatory boundary is considered fishing the edge of the reserve). Fishing the edge of the reserve may be different depending on the fishery and the individual reserve.</li> </ol>
Monitoring Activity: Collecting new data
<p>Justification:</p> <p>Measuring the amount of people/boats fishing the edge of the marine reserve will address whether fishing is occurring on the edge of the reserve, what fisheries are taking place at the edge of the reserve and whether there are any economic costs or benefits to fishing the edge. Information gathered on fishing the edge of the reserve can be used in conjunction with other monitoring programs (basic consolidation of landings information) to look at possible small scale displacement of individuals from traditional fishing areas.</p> <p>Fishing on the edge of a reserve may also be perceived as the best place to fish, but it may not be any more economically beneficial than other areas. It is important to measure activity as a response to a perception. This perception may change with the length of time the reserves are in place. It is also possible that in time it the real benefits and/or costs to fishing the edge of the reserve will change.</p> <p>Understanding conflicts among industry participants as well as between industry and recreational users is important to monitoring the cultural impacts of marine reserve implementation.</p>
<p>Data Collected:</p> <p>Are people fishing the line and is there crowding on the edge of the reserve:</p> <ol style="list-style-type: none"> <li>1. Some information may be available through logbooks.</li> <li>2. Observational data collected at each reserve.</li> <li>3. Individual interviews of the perception of whether crowding is occurring and whether fishing the edge of the reserve is increasing or decreasing revenue. Economic return and/or cost associated with fishing the edge of a reserve: This question may be addressed through a sentinel program that allows fishing inside the reserve, at the edge of the reserve and outside the reserve in a control area. Individual landing information would complement this program.</li> </ol>
Timing: 5 months from collection to product. Data collection ongoing
Spatial Resolution/Scope: 1X1 nm
Cost: >\$100,000
<p>Staff:</p> <p>2 Full Time Employees, could be volunteers</p> <p>Any interviewers would need approval by industry participants. Volunteers may be graduate students. On the water observations would require the use of a vessel and the associated costs as well as knowledgeable personnel to identify different types of fishing activity.</p>
<p>Funding Sources:</p> <p>Sea Grant</p> <p>Saltonstall - Kennedy</p> <p>Department and Sanctuary vessels may be available for use.</p>

<b>Group: Commercial Fishing</b>
<p><b>Question/Topic/Goal: Displacement</b></p> <p>Measure size and extent of displacement - where vessels and people have gone, substitution to other, non-fishing income activities (I.e. capacity reduction), other fisheries, other areas; distinguish between direct effects (people leaving) and indirect effects (other areas/people who are impacted; congestion); activities are both 1 and 2; ditto for data collection</p>
<p><b>Monitoring Activity:</b></p> <p>collecting new data</p>
<p><b>Justification:</b></p> <p>To better assess how area-based management affects fishermen, industry and coast as a whole, to fulfill regulatory obligations, to avoid future lawsuits (National Standard 8), and to fill critical socioeconomic data gaps for marine and fishery management.</p>
<p><b>Data Collected:</b></p> <p>Use past landing records to design sample/panel of fishermen to compare to those who used to fish inside CINMS (e.g. similar proportion, composition of landings), track by logbooks/fish landing receipts in terms of changed spatial behavior; regional stratification may depend on species; add interview layer to elicit reasons for movement; historical data from panel for underlying trends in spatial behavior; draw on CDFG analysis done for restricted access programs, for fisheries profiles/characterizations (contact Mike Weber, RATP);</p>
<p><b>Timing:</b></p> <p>12 months from collection to compilation ongoing surveys</p>
<p><b>Spatial Resolution/Scope:</b></p> <p>Will Vary</p>
<p><b>Cost:</b></p> <p>\$375,000</p>
<p><b>Staff:</b></p> <p>2 Full Time Employees, Need fulltime supervisor/PI Could use volunteers - Using fishermen who consent to be on study panels; confidentiality issue needs to be resolved (socioeconomic study wide); may be able to rely on existing marine research, institutes, outreach and educational activities for additional information.</p>
<p><b>Funding Sources:</b></p> <p>collaboration with MLPA process b/c regional working groups structure, protocol, and data availability potentially helpful; leverage for SK funding, as model for assessing reserve impacts on different fisheries; leveraging for PacFIN data enhancement work, Pacific States</p>

<b>Group: Commercial Fishing</b>
<p>Question/Topic/Goal: <b>Knowledge, Attitudes, and Perceptions</b></p> <p>Surveying commercial fishermen on knowledge, perceptions and attitudes, over time, related to MPAs in CINMS</p>
<p>Monitoring Activity:</p> <p>Designing a survey (list of questions) to be administered to fishermen every year. This should be coordinated with fishermen's panels and other panels (biologic and social). Primarily new data collection, with minimal use of existing data and some analysis</p>
<p>Justification:</p> <p>Important feedback to management including revelation of misinformation, to determine from where users obtain information, the levels of awareness and understanding, needs for outreach, education and adaptive management, public response MRWG, goals/objectives, important feedback to wider fishery management, development of the necessary relationships for data acquisition for users, the hypothesis-driven, defensible research.</p>
<p>Data Collected:</p> <p>Information must be gathered on Knowledge, Attitudes, and Perceptions, Profiles of Users, Effects of other regulations and management strategies on users, and spatial distributions of measurements.</p> <p>Could incorporate minimal old data mining? Baseline data through MMS study, Wetfish report, SEA Grant study, Squid, Salmon</p> <p>Fishermen should be included</p> <p>Could use a panel approach or focus groups (periodic) as well as ethnography (interviews) to identify issues and concerns</p> <p>Questionnaire design must use good stratified random samples for producing measurements to compare over time.</p> <p>Include others engaged in fishing industries (i.e. wetfish buyers)</p> <p>2 panels – fishing dependent business</p>
<p>Timing:</p> <p>Vary by tool, 15-18 months from collection to compilation</p> <p>Survey every 3 years (ethnographic)</p> <p>*Make sure that we can use this comparatively with other user groups/panels</p>
<p>Spatial Resolution/Scope:</p> <p>Monterey Bay to San Diego</p> <p><i>ENHANCED:</i> Fishery-wide</p>
<p>Cost:</p> <p>Requires cost sharing from other efforts; share effort</p>
<p>Staff:</p> <p>There is inadequate staff within agency</p> <p>Panel</p> <p>3 Full Time Employees to design tool</p>
<p>Funding Sources:</p> <p>NOAA (need some social scientists), Foundations, Fish and Game</p>

<b>Group: Commercial Fishing</b>
<b>Question/Topic/Goal: General Commercial Fishing Profiles</b> A stratified random sample of fishermen fishing in the CINMS as defined by the 22-CDFG blocks used in Leeworthy and Wiley (2002). Obtain Socioeconomic profiles to track whether commercial fishing panels are representative of commercial fishing population. Need baseline.
<b>Monitoring Activity:</b> collecting new data
<b>Justification:</b> This general survey sample of commercial fishermen fishing in the CINMS is necessary to check whether the commercial fishing panels are representative of the commercial fishermen population. It will provide the necessary information needed to adjust panels over time.
<b>Data Collected:</b> Socioeconomic Profiles of Commercial Fishermen that fish in CINMS: 1. Stratified random sample of all CINMS fishermen. 2. Stratified by type of fishery and extent of catch. 3. Catch, Value of Catch (ex vessel), Species/Species Groups, Age, Race/Ethnicity, Experience (years of fishing and years of fishing in CINMS), Education (years of schooling), Dependency on fishing (percent of Income from fishing), Percent of Revenue from fishing from CINMS by Species/Species Group, People directly employed and family members supported, Ownership/Investment (replacement value of boats and equipment), Residence (home city and state), and Main Port where land catch.
<b>Timing:</b> 6 months from collection to product Once every five years
<b>Spatial Resolution/Scope:</b> 22-block definition of CINMS
<b>Cost:</b> \$50,000 - \$100,000
<b>Staff:</b> 2 Full Time Employees (4 people for 6 months), could be volunteers Any interviewers would need approval by industry participants. Volunteers may be graduate students.
<b>Funding Sources:</b> CINMS and/or CDFG Sea Grant Saltonstall - Kennedy

## Joint Working Group on Education, Research, and Outreach

<b>Group: Education, Research, and Outreach</b>
Question/Topic/Goal: <b>Educator Tracking</b> For education: be able to track number of educators and participants in education programs relating to marine reserve areas and added value of marine reserve areas for these programs.
Monitoring Activity: collecting new data
Justification: Want to measure whether there is a change in number of educational activities as a result of marine reserves in the Channel Islands.
Data Collected: volunteer registration of education activities through web Ensure marine reserves messages in educational programs Provide education materials to all Electronic newsletter to educators Coordinate with professional educational organizations such as NMEA, SWMEA, CREEK Network, and Sanctuary Education Team Informal contacts with education community
Timing: Ongoing?
Spatial Resolution/Scope: N/A
Cost: Unknown
Staff: Minimal Full Time plus volunteers
Funding Sources: Channel Islands National Marine Sanctuary, Foundations, Etc.

<b>Group: Education, Research, and Outreach</b>
Question/Topic/Goal: Research Permit Tracking
Monitoring Activity: Use existing data and implement tracking program
Justification: Required by law, minimize impacts, get a central database to make sure research activities do not conflict with one another.
Data Collected: Guided by MLPA, FG will require special permit for research in all reserves, permits are site specific and must be used for site management, better chance of occurring if use least invasive method, reports will be required Implementations should occur in the following manner: Sanctuary and Fish and game coordinate on issuing permits, and Sanctuary gets a copy of all permits for CINMS marine reserve areas. Permits should track research funding. Develop one permit for all (park, sanctuary and all agencies), get one permit on web
Timing: Ongoing
Spatial Resolution/Scope: N/A
Cost: Existing
Staff: Existing Fish and Game Staff plus Sanctuary and Park coordination
Funding Sources: Existing Agency



<b>Group: Education, Research, and Outreach</b>
Question/Topic/Goal: Research Project Registration Voluntary registration of research projects in marine reserves
Monitoring Activity: New data collection
Justification: Permits don't capture all of research activities, especially those which do not have an impact on living resources.
Data Collected: Website, informal contacts w/in scientific community, symposium to allow researcher to learn what others are doing, science panel meetings.
Timing: New project, ongoing
Spatial Resolution/Scope: N/A
Cost: Unknown
Staff: Perhaps 1 full time
Funding Sources: Foundations/Agencies

<b>Group: Education, Research, and Outreach</b>
<b>Question/Topic/Goal: Public Outreach</b> Inform users and non-users about the results (biological and socio-economic) of marine reserve monitoring programs
<b>Monitoring Activity:</b> Summarization of program results.
<b>Justification:</b> Improved knowledge and public awareness of marine reserves.
<b>Data Collected:</b> Web (results of biological and socio-economic data in user-friendly format), e-newsletter, presentations, list-serve for disasters, speakers bureau, press releases and op-ed pieces, events, updated displays (capitalize World Oceans Day and Earth Day)  NOTE: Pre-Workshop survey results recommend the following: 75% - Want Internet updates 69% - Want newsletters (25% bi-annual, 20% quarterly, 16% annual, 8% more often) 66% - Want Fish and Game Commission meeting updates (29% annual, 29% bi-annual, 8% more often) 50% - Want Sanctuary Advisory Council meeting updates 50% - Want large annual public meeting updates 45% - Want smaller town hall meeting updates (29% annual, 8% bi-annual, 8% more often)
<b>Timing:</b> See Above recommendations for timing
<b>Spatial Resolution/Scope:</b> N/A
<b>Cost:</b> Included in existing Agency funds.
<b>Staff:</b> Included in existing Agency Staffing
<b>Funding Sources:</b> Included in existing Agency funds.

<b>Group: Education, Research, and Outreach</b>
<p>Question/Topic/Goal: <b>Use of Volunteers</b></p> <p>Include volunteers in monitoring of marine reserves at all levels (socio-economic and biological)</p>
<p>Monitoring Activity:</p> <p>Various volunteer programs.</p>
<p>Justification:</p> <p>A way to engage the local community in ocean stewardship.</p>
<p>Potential Programs:</p> <p>Research</p> <p>*REEF fish surveys</p> <p>Bird Monitoring</p> <p>Marine Mammals Monitoring</p> <p>Fish Monitoring</p> <p>Human activity monitoring (environmental disturbance)</p> <p>*Educational docent/naturalist programs (CI Naturalist Corp)</p> <p>help during natural or man-made disasters (HAZ Wopper training, maintain list of trained volunteers)</p> <p>Beach Monitoring</p> <p>Surveys of marine reserve use</p> <p>Monitoring research and education activities</p> <p>How to Implement:</p> <p>work with educational institutions</p> <p>Outreach to all parties about volunteers (adult ed, etc)</p> <p>Speaker's bureau</p> <p>Important to track all volunteer hours and events</p> <p>Need budget to cover volunteer programs</p> <p>Possible donations to foundation for volunteer services/sponsorship</p> <p>Partnership between CINMS/CINP and private, academics, etc.</p> <p>Website to facilitate volunteer participation (links to all on-going volunteer activities and contact info, CINMS to act as a portal)</p> <p>Volunteer Diver Program, need for scientific diving training/certification to AAUS standard</p> <p>NGO involvement – educational enforcement (Sanctuary marine watch), monitor on-site uses of MPAs, supply matching funds.</p>